1.0 Phase III Accreditation Support Package Description

Phase III accreditation support is comprised of two distinct activities: detailed code verification and validation at the functional element (FE) and overall model levels. Code verification includes desk checking, software testing, and comparison of the code with design specifications. Validation is accomplished through assessments based upon comparisons between FE and/or model predictions with real-world data from a variety of sources (e.g., developmental, operational, laboratory, and/or bench testing, S&TI or FME reports). Each of these activities is described in greater detail below; figure1.0-1 depicts the major Phase III accreditation support activities defined by the SMART Project Office.

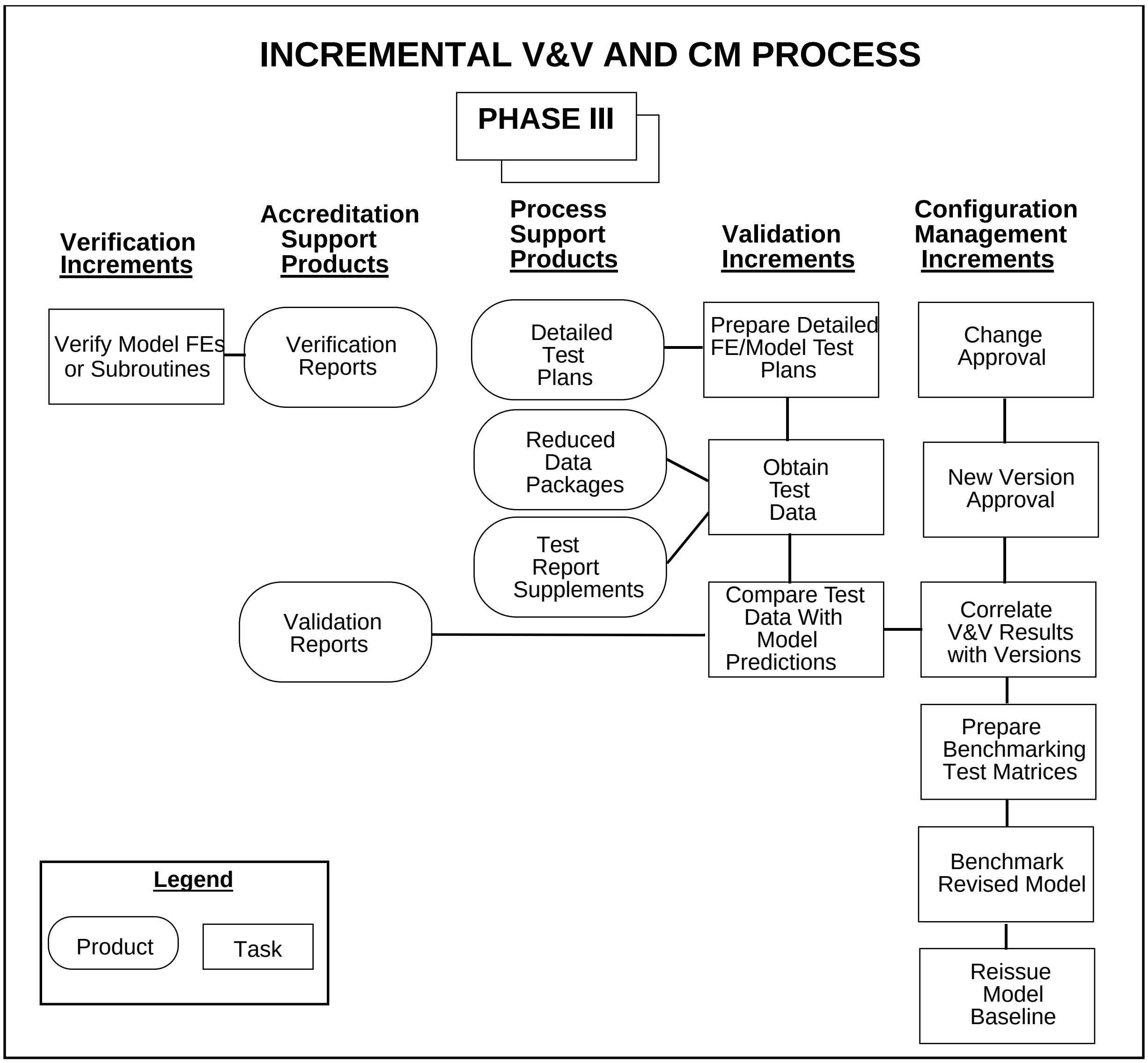

Figure 1.0-1 Phase III Accreditation Support Activities

1.1 Code Verification

The purpose of code verification is to provide a detailed examination of the physical code. This is usually accomplished by looking at individual modules until the model or simulation has been examined in its entirety. The main objective of this task is to ensure that design requirements have been satisfied and that the algorithms and equations being used are properly implemented in the code. A second objective is to ensure that appropriate coding practices are being used and that the software can actually be executed as implemented.

Code verification consists of four major elements:

a. correlating design requirements with cited references;

b. correlating code implementation with the design specifications;

c. code auditing for correctness of implementation; and

d. testing of all executable statements.

Detailed descriptions of each element can be found in the *SMART VV&CM Process* document [1].

The verification results presented in Section 2.0 provide the prospective model user with a determination of how accurately the model's code implementation represents the conceptual description specified by the developer, as well as an assessment of how closely the model code follows the design specifications. It contains a summary of verification activities for this model up to the present time, a description of the verification methodology employed, a summary of verification findings, listings of deficiencies discovered during verification efforts, and an assessment of the impact of these findings on model use.

1.2 Validation with Test Data

Validation procedures vary from simple to complex in accordance with the function or phenomena being simulated (validated) and the ease with which the phenomena tested can be represented by the model. At the FE level, bench-test data in the form of characteristic response curves and single point measurements can often be used to assess the representation of a function (e.g., a servo) in the model. At the model level, several or all of the functions are usually exercised in an attempt to predict data that was collected from an operational test. Comparisons of these predictions with actual measurements usually leads to statistical goodness of fit or correlation values that are used to assess the validity of the model or the function for the type of situation or scenario during which the data were collected.

Validation results provided in Section 3.0 are descriptions and results of assessments that have been applied to functional elements of the model. These consist of graphical and statistical comparisons of test data measurements and FE predictions. The section is subdivided into FE and test data descriptions, assessment procedures, results, and conclusions.

1.3 Organization of ASP III

The SMART Project has developed a unique concept for the conduct of verification and validation of models and simulations. RF sensor models are divided into seven functional areas: target characteristics, propagation, transmitter, receiver, antenna, signal processing, and target tracking. These functional areas have been further subdivided into functional elements as shown in the Functional Area Template of figure 1.3-1. The Functional Area Template decomposes RF models into generic, identifiable functional elements (FEs) which match those of the real-world radar system, target, and environment.

RF SENSOR FUNCTIONAL AREA TEMPLATE (FAT)

1.0 TARGET CHARACTERISTICS
- 1.1 FLIGHT PATH
- 1.2 SIGNATURE
  - 1.2.1 RCS
    - 1.2.1.1 STATIC
    - 1.2.1.2 DYNAMIC
  - 1.2.2 FLUCTUATIONS
- 1.3 ECM
  - 1.3.1 NOISE
    - 1.3.1.1 ON BOARD
    - 1.3.1.2 OFF BOARD
    - 1.3.1.3 STANDOFF
  - 1.3.2 DECEPTIVE
    - 1.3.2.1 ON BOARD
    - 1.3.2.2 OFF BOARD
    - 1.3.2.2 STANDOFF

2.0 PROPAGATION
- 2.1 MASKING
- 2.2 CLUTTER
- 2.3 MULTIPATH/DIFFRACTION
- 2.4 ATMOSPHERIC ATTENUATION

3.0 TRANSMITTER
- 3.1 WAVEFORM GENERATOR

4.0 RECEIVER
- 4.1 THERMAL NOISE
- 4.2 AGC
- 4.3 DETECTOR
- 4.4 BLANKING

5.0 ANTENNA
- 5.1 ANTENNA GAIN
- 5.2 ANTENNA SCAN

6.0 SIGNAL PROCESSING
- 6.1 THRESHOLD
- 6.2 CLUTTER REJECTION
  - 6.2.1 MTI
  - 6.2.2 DOPPLER FILTERS
- 6.3 INTEGRATION
- 6.4 PULSE COMPRESSION

7.0 TARGET TRACKING
- 7.1 ANGLE
- 7.2 RANGE
- 7.3 DOPPLER

Figure 1.3-1 RF Sensor Functional Area Template

For purposes of the ASP documentation set, a simpler numbering scheme to cover all FEs was required. The simplest scheme was adopted: FEs were taken in FE number order and renumbered sequentially. For each FE, the same number has been used across both ASP II and ASP III. Names, FAT numbers, and ASP numbers are listed in table 1.3-1 below.

In ASP III, verification information is found in section 2.*n*, where section *n* corresponds to a specific FE. Validation results are included in section 3.*n*, where section *n* corresponds to a specific FE.

Table 1.3-1 Correspondence of FAT Numbers and ASP FE Section Numbers

FAT Number	FE Name	ASP Number
1.1	Flight Path	1
1.2.1.1	Radar Cross Section (Static)	2
1.2.1.2	Radar Cross Section (Dynamic)	3
1.2.2	Signature Fluctuations	4
1.3.1.1	ECM- On-board Noise	5
1.3.1.2	*ECM- Off-board Noise	6
1.3.1.3	ECM- Stand-off Noise	7
1.3.2.1	ECM- On-board Deceptive	8
1.3.2.2	*ECM- Off-board Deceptive	9
1.3.2.3	*ECM-Stand-off Deceptive	10
2.1	Masking	11
2.2	Clutter	12
2.3	Multipath/Diffraction	13
2.4	Atmospheric Attenuation	14
3.1	Waveform Generator	15
4.1	Thermal Noise	16
4.2	*Automatic Gain Control (AGC)	17
4.3	Detector	18
4.4	Blanking	19
5.1	Antenna Gain	20
5.2	*Antenna Scan	21
6.1	Threshold	22
6.2.1	Clutter Rejection- Moving Target Indicator (MTI)	23
6.2.2	Clutter Rejection- Doppler Filters	24
6.3	Signal Integration	25
6.4	Pulse Compression	26
7.1	*Angle Track	27
7.2	*Range Track	28
7.3	*Doppler Track	29
*Not implemented in ALARM 3.0		